

NON-PUBLIC?: N
ACCESSION #: 9211040146
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Palo Verde Unit 1 PAGE: 1 OF 7

DOCKET NUMBER: 05000528

TITLE: Reactor Trip Caused by Actuation of the Sub-Synchronous Trip
EVENT DATE: 09/28/92 LER #: 92-012-00 REPORT DATE: 10/24/92

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Thomas R. Bradish, Compliance TELEPHONE: (602) 393-5421
Manager

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

At approximately 2137 MST On September 28, 1992, Palo Verde Unit 1 was in Mode 1 (POWER OPERATION) operating at approximately 100 percent power when a Unit 1 Main Turbine trip occurred followed by a reactor trip on high pressurizer pressure. The Shift Supervisor classified the event as an uncomplicated reactor trip in accordance with Emergency Plan Implementing Procedures. At approximately 2250 MST on September 28, 1992, the plant was stabilized in Mode 3 (HOT STANDBY). No other safety system responses occurred and none were required.

APS Plant Engineering has determined that the cause of the reactor trip was the spurious, partial actuation of the Sub-synchronous Auxiliary Relay. The apparent cause of the actuation of the relay was the touching of an AC soldering iron to an energized 125V DC alarm circuit during performance of corrective maintenance. Contributing factors to the event included relay gap settings, which were less than the vendor

specifications, and the sensitivity of the Auxiliary Relay to minor voltage transients.

The utilization of soldering irons on energized equipment was restricted and interim guidance for work on energized equipment was provided.

There have been no previous similar events reported pursuant to 10CFR50.73.

END OF ABSTRACT

TEXT PAGE 2 OF 7

I. DESCRIPTION OF WHAT OCCURRED:

A. Initial Conditions:

At 2137 MST on September 28, 1992, Palo Verde Unit 1 was in Mode 1 (POWER OPERATION) at approximately 100 percent power.

B. Reportable Event Description (Including Dates and Approximate Times of Major Occurrences):

Event Classification: An event that resulted in an automatic actuation of the Reactor Protection System (RPS) (JC).

At approximately 2137 MST on September 28, 1992, a Unit 1 Main Turbine (TA) trip occurred followed by a reactor (RCT)(AC) trip on high pressurizer (AB) pressure. The Shift Supervisor (utility, licensed) classified the event as an uncomplicated reactor trip in accordance with Emergency Plan Implementing Procedures. At approximately 2250 MST, on September 28, 1992, the plant was stabilized in Mode 3 (HOT STANDBY). No other safety system responses occurred and none were required. The turbine trip was determined to have been caused by the actuation of the Sub-synchronous Auxiliary Relay (TB) (RLY) (81).

Prior to the event, two electrical maintenance technicians (EMTs) (utility, non-licensed) were performing corrective maintenance on a Unit 1 Main Transformer (EL) Cooling Control Cabinet. The work consisted of replacing the 125V DC alarm relay (IB) (74) that provides local and remote (Control Room) alarm annunciation (IB). The Control Room alarm function was

not working. Before commencing work, the EMTs reviewed the package with their lead electrician (utility, non-licensed) and one of the EMTs went to the Control Room and discussed the job scope with the Control Room Supervisor (utility, licensed). The work package stated that the work could be performed while the control cabinet was energized and that, previously, similar work had been done with the cabinet energized. Operations personnel (utility, licensed) preferred that the alarms for the control cabinet remain available and allowed the work to be performed with the equipment energized.

At approximately 2137 MST, a momentary ground alarm sounded in the Control Room (NA) on annunciator panel B01 (IB). At approximately the same time that the ground alarm sounded, the first lead on the 125V DC alarm relay was being disconnected by solder joint removal. As the second lead was being disconnected, the EMTs heard steam being released from the Unit. The steam was being discharged

TEXT PAGE 3 OF 7

through the Steam Bypass Control Valves (SBCV) (JI) as expected in response to the transient. The EMTs immediately stopped work, contacted the Control Room, and advised Operations personnel of the actions they had been performing.

While responding to the ground alarm, a Reactor Operator (utility, licensed) observed the "SSR LOCKOUT TRIP" (Sub-synchronous relay lockout trip) annunciator on Control Room annunciator panel B01, which was followed by a turbine trip. The Control Room Supervisor gave direction to the Reactor Operators to drive control rods in to the core to reduce reactor power and prevent a reactor trip. The high pressurizer pressure alarm annunciated and, while the Reactor Operator was selecting manual sequential on the Control Element Assemblies (CEA) (AA) control selector switch, RPS channels "A" and "C" tripped the reactor on high pressurizer pressure. CEAs were not selected for reactor power cutback (RPCB) (JD) large load reject event due to a deficiency that had been identified with Control Element Assembly Calculator (CEAC) (AA) software for RPCB during a previous Unit 3 event (LER 530/91-008-00).

The plant was stabilized in Mode 3 (HOT STANDBY) at approximately 2250 MST. The Shift Supervisor classified the event as an uncomplicated reactor trip in accordance with Emergency Plan Implementing Procedures. No other safety system

responses occurred and none were required.

C. Status of structures, systems, or components that were inoperable at the start of the event that contributed to the event:

Although corrective maintenance was in progress on the Unit 1 Main Transformer Cooling Control Cabinet as described in Section I.B, no structures, systems, or components were inoperable at the start of the event which contributed to this event.

D. Cause of each component or system failure, if known:

Not applicable - no component or system failures were involved.

E. Failure mode, mechanism, and effect of each failed component, if known:

Not applicable - no component failures were involved.

F. For failures of components with multiple functions, list of systems or secondary functions that were also affected:

Not applicable - no failures of components with multiple functions were involved.

TEXT PAGE 4 OF 7

G. For a failure that rendered a train of a safety system inoperable, estimated time elapsed from the discovery of the failure until the train was returned to service:

Not applicable - no failures that rendered a train of a safety system inoperable were involved.

H. Method of discovery of each component or system failure or procedural error:

Not applicable - there have been no component or system failures or procedural errors identified.

I. Cause of Event:

An investigation of this event was conducted in accordance with the APS Incident Investigation Program. As part of the

investigation, APS Plant Engineering has initially determined that the apparent cause of the reactor trip was the spurious, partial actuation of a Sub-synchronous Auxiliary Relay which occurred when an AC soldering iron was touched to an energized terminal of the 125V DC alarm relay during performance of corrective maintenance (SALP Cause Code X: Other). Contributing factors to the event included relay gap settings which were less than the vendor specifications, and the sensitivity of the Auxiliary Relay to minor voltage transients.

An Equipment Root Cause of Failure Analysis is being performed to determine the cause of the actuation of the Sub-synchronous Auxiliary Relay. This analysis is expected to be completed by January 1, 1993. If the analysis results differ significantly from the apparent cause, a supplement to this report will be submitted to describe the final root cause of failure.

APS Plant Engineering personnel concluded that the soldering iron being used to unsolder an energized terminal caused a voltage transient on the negative DC bus resulting in a current flow through the Sub-synchronous Auxiliary Relay to ground. The current flow caused the armature of the relay to move slightly. This movement resulted in one of the relay contacts to momentarily close. The closing of this contact resulted in a trip signal being sent to the turbine control circuitry, tripping the Main Turbine.

The Main Turbine/Main Generator (TA/TB) is equipped with two independent sub-synchronous relays. These relays are connected through Current (XCT) and potential (XPT) transformers to the Main Generator terminals. There are several frequencies where transmission line sub-synchronous frequencies can interact with the Main Turbine/Main Generator shaft. This can cause destructive

TEXT PAGE 5 OF 7

damage to the Main Turbine/Main Generator shaft. To prevent this, the sub-synchronous relays send a trip signal to an auxiliary relay (RLY), in turn the auxiliary relay initiates the opening of the 525kV Main Generator breakers (52), located in the switchyard (FK), and initiating a turbine trip. The Auxiliary relays have extremely fast operating characteristics.

This event was also evaluated in relation to the May, 1992, Unit 3 Loss of Annunciator Event (Special Report 3-SR-92-002)

including the lessons learned from the Unit 3 event. Based on interviews and personnel statements, the Unit 1 EMTs were aware of the Unit 3 event. During the pre-job briefing, the EMTs discussed the precautions necessary for work on energized equipment and the EMTs worked the job cautiously.

No unusual characteristics of the work location (e.g., noise, heat, poor lighting) directly contributed to this event. There were no identified procedural or personnel errors which contributed to this event.

J. Safety System Response:

Other than the RPS trip on high pressurizer pressure discussed in section I.B, no other safety system responses occurred and none were necessary.

K. Failed Component Information:

Not applicable - no component failures were involved.

II. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT:

Nuclear Fuel Management (NFM) performed an assessment of the event and determined that the equipment and systems assumed in the Updated Final Safety Analysis Report (UFSAR) Chapter 15 were functional and performed as required. No abnormal transients were identified following the reactor trip. Scenarios defined in UFSAR Chapter 6 concerning loss of coolant (LOCA) were not challenged during this event.

The assessment concluded that the event did not result in a transient more severe than those already analyzed. No safety system actuations occurred and none were required. The event did not result in any challenges to the fission product barriers or result in any releases of radioactive materials. Therefore, there were no adverse safety consequences or implications as a result of this event. This event did not adversely affect the safe operation of the plant or the health and safety of the public.

TEXT PAGE 6 OF 7

III. CORRECTIVE ACTION:

A. Immediate:

Soldering activities on energized equipment were stopped and interim guidance for work on energized equipment was provided. A letter, dated September 30, 1992, was issued to the Plant Managers providing interim guidance for work on energized equipment. The guidance included the suspension of all soldering activities on energized equipment without specific approval from the responsible Maintenance Manager. The guidance also included direction to the Maintenance Managers to perform an assessment of risk to plant equipment, systems, and personnel prior to allowing corrective maintenance work to proceed on energized equipment. This interim guidance will

remain in effect pending development of a policy to control work activities on energized equipment.

The Sub-synchronous Auxiliary Relay which actuated in Unit 1 has been replaced.

B. Action to Prevent Recurrence:

This event will be evaluated in accordance with approved procedures for inclusion into Industry Events Training for Operations, Maintenance, and Work Control. The evaluation is scheduled to be completed by December 9, 1992.

As part of the Action to Prevent Recurrence for the May 3, 1992 Unit 3 Annunciator Event, as identified in the response to Notice of Violation (NOV) 530/92-19-01, a formal policy for working on energized circuits is being developed. The policy is scheduled for completion at the end of 1992.

An Equipment Root Cause of Failure Analysis is being performed to determine the cause of the actuation of the Sub-synchronous Auxiliary Relay. This analysis is expected to be completed by January 1, 1993. If the analysis results differ significantly from the apparent cause, a supplement to this report will be submitted to describe the final root cause of failure.

IV. PREVIOUS SIMILAR EVENTS:

There are no previous similar events reported pursuant to 10CFR50.73

V. ADDITIONAL INFORMATION:

Based on reviews by the Plant Review Board, the Management Response Team and the Plant Manager, a Unit restart was authorized in accordance with approved procedures. Unit 1 entered Mode 2 (STARTUP) at approximately 1908 MST on October 1, 1992 and Mode 1 (POWER OPERATION) at approximately 0230 MST on October 2, 1992. Unit 1 synchronized to the grid at approximately 1136 MST on October 2, 1992.

ATTACHMENT 1 TO 9211040146 PAGE 1 OF 1

Arizona Public Service Company
PALO VERDE NUCLEAR GENERATING STATION
P.O. BOX 52034 o PHOENIX, ARIZONA 85072-2034

192-00803-JML/TRB/RR
JAMES M. LEVINE October 24, 1992
VICE PRESIDENT
NUCLEAR PRODUCTION

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Mail Station P1-37
Washington, D.C. 20555

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 1
Docket No. STN 50-528 (License No. NPF-41)
Licensee Event Report 92-012-00
File: 92-020-404

Attached please find Licensee Event Report (LER) 92-012-00 prepared and submitted pursuant to 10CFR50.73. This LER reports the Unit 1 Reactor trip caused by the actuation of the Sub-Synchronous Auxiliary Relay during corrective maintenance on a Main Transformer Alarm Relay. In accordance with 10CFR50.73(d), a copy of this LER is being forwarded to the Regional Administrator, NRC Region V.

If you have any questions, please contact T. R. Bradish, Compliance Manager, at (602) 393-5421.

Very truly you

JML/TRB/RR/mh

Attachment

cc: W. F. Conway (all with attachment)

J. B. Martin

J. A. Sloan

INPO Records Center

*** END OF DOCUMENT ***
